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(54) **ISOLATION VALVE**

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(51) **Int. Cl.**[7] **E21B 34/10**
(52) **U.S. Cl.** **166/375**; 166/386; 166/321
(58) **Field of Search** 166/386, 375, 166/319, 321, 331, 240

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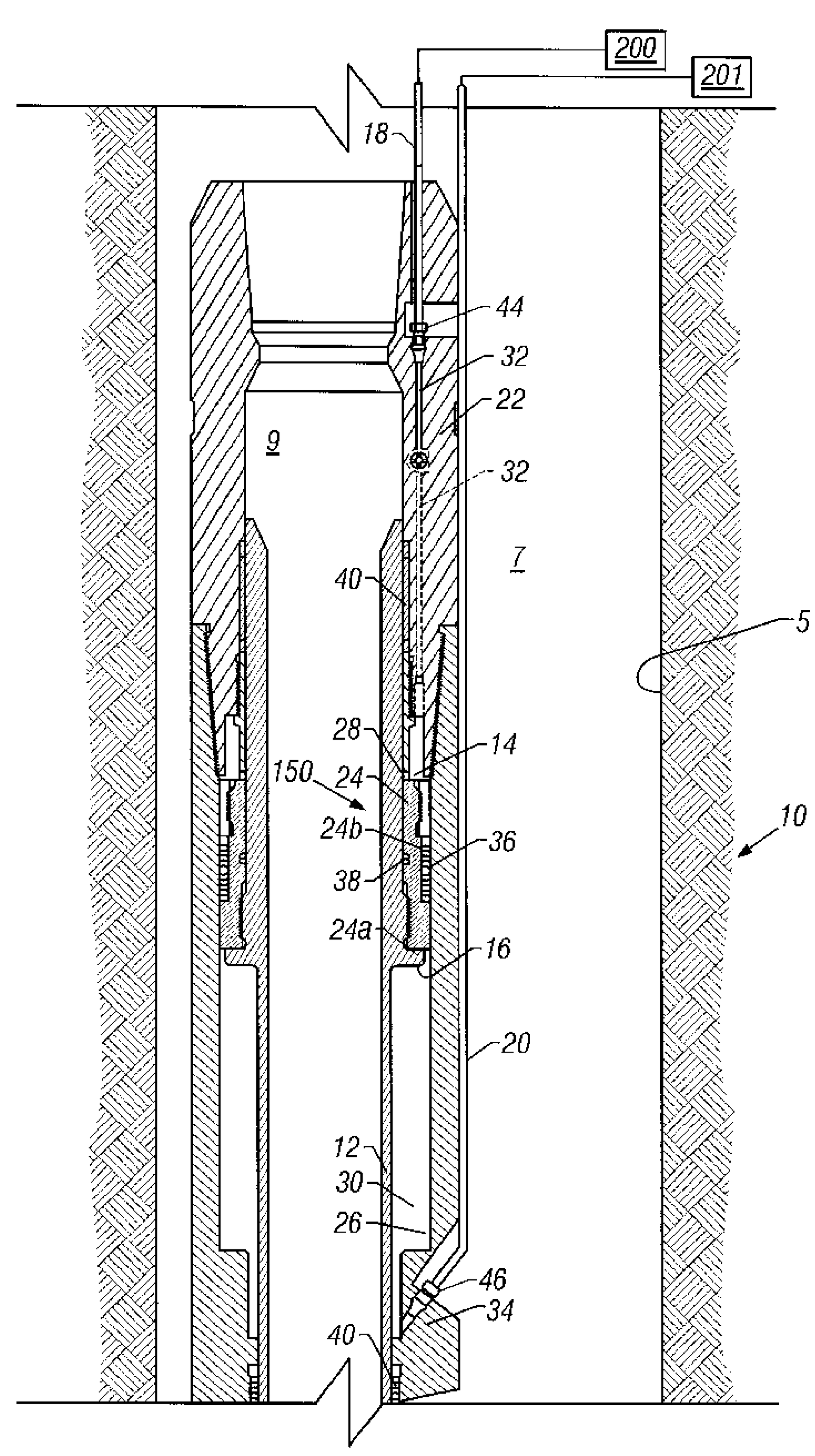
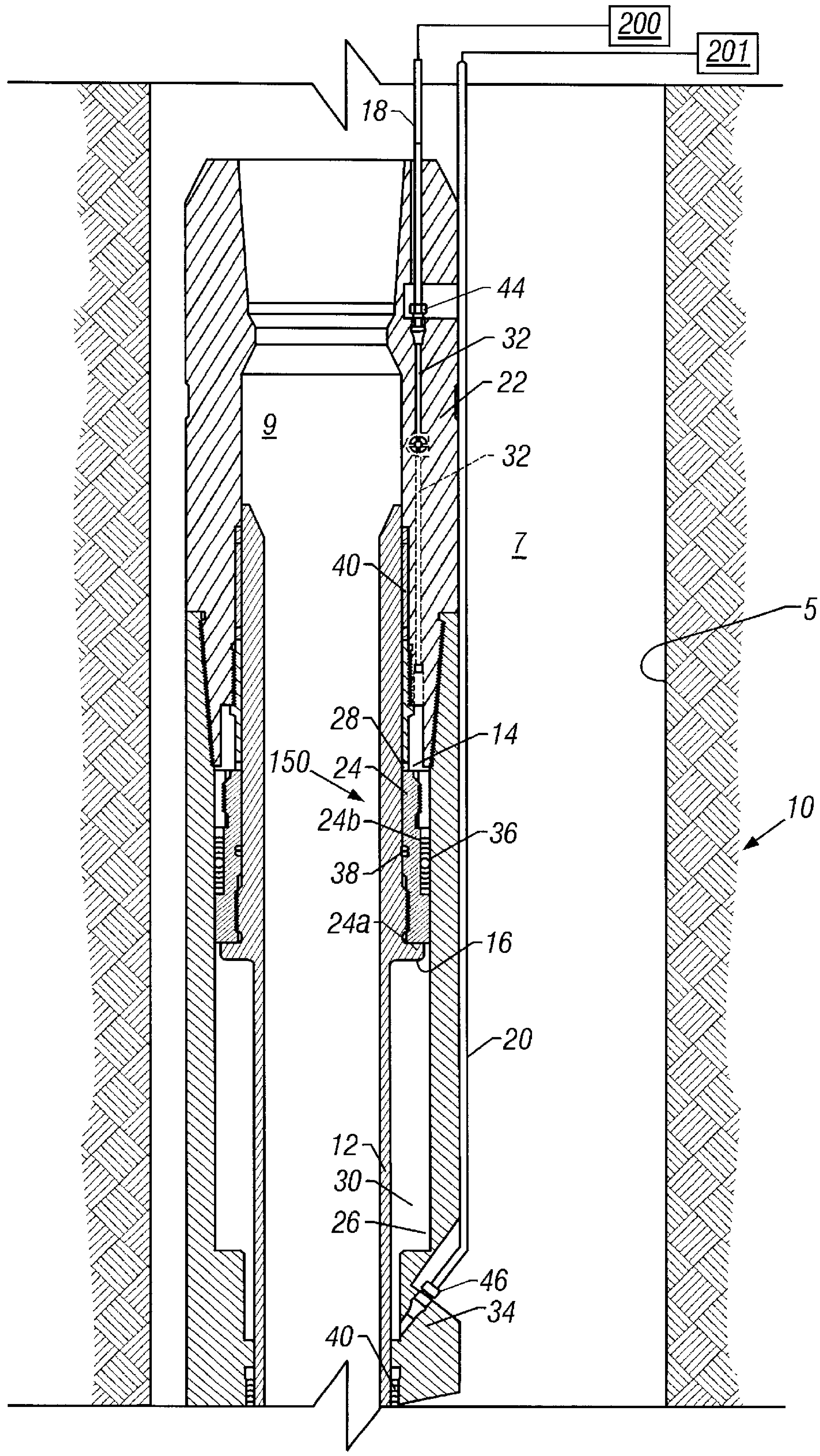
(57) **ABSTRACT**

A downhole valve that may be opened and closed by alternatingly pressurizing/bleeding a first control line, which is in fluid communication with a first surface of an activating member, and a second control line, which is in fluid communication with a second surface of the activating member. The fluid within the control lines is the same density as the fluid found in the annulus of the wellbore. The development of a leak in the control lines therefore does not by itself result in the actuation or movement of the activating member or valve member.

38 Claims, 8 Drawing Sheets

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201
18
44
32
22
9
32
7
40
5
28
14
150
24
24b
36
38
10
24a
16
20
12
30
26
46
34
40

FIG. 1A

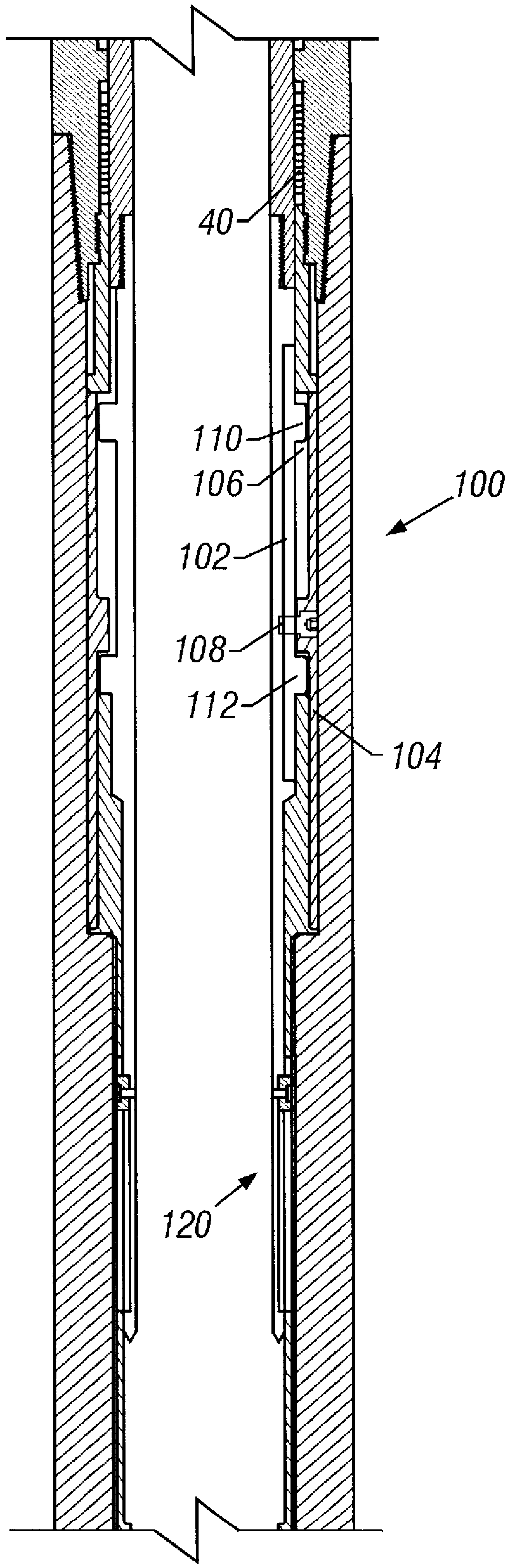


FIG. 1B

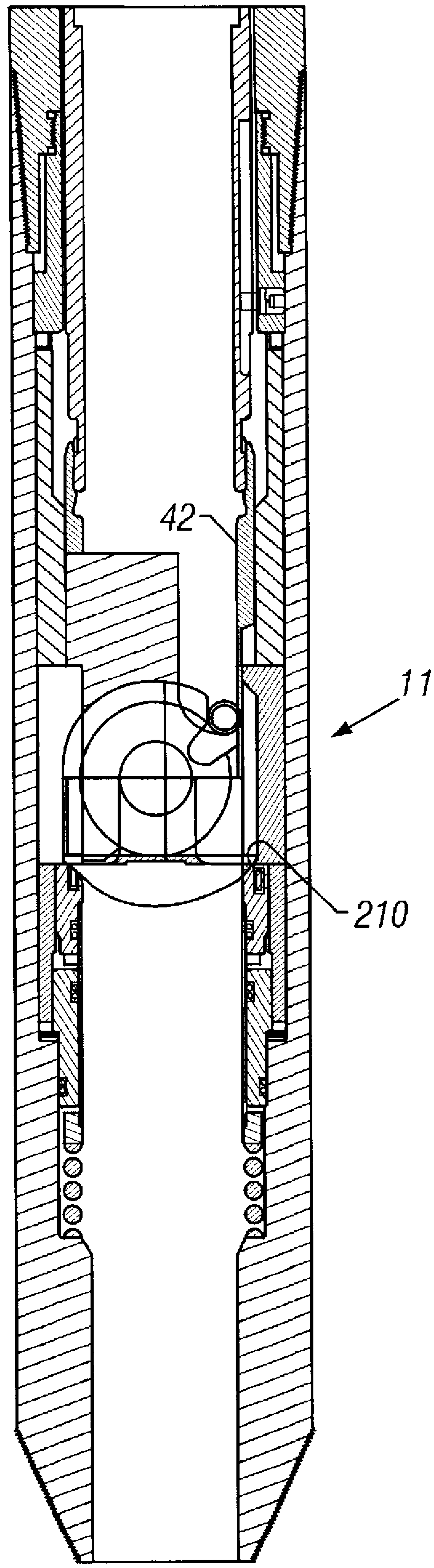
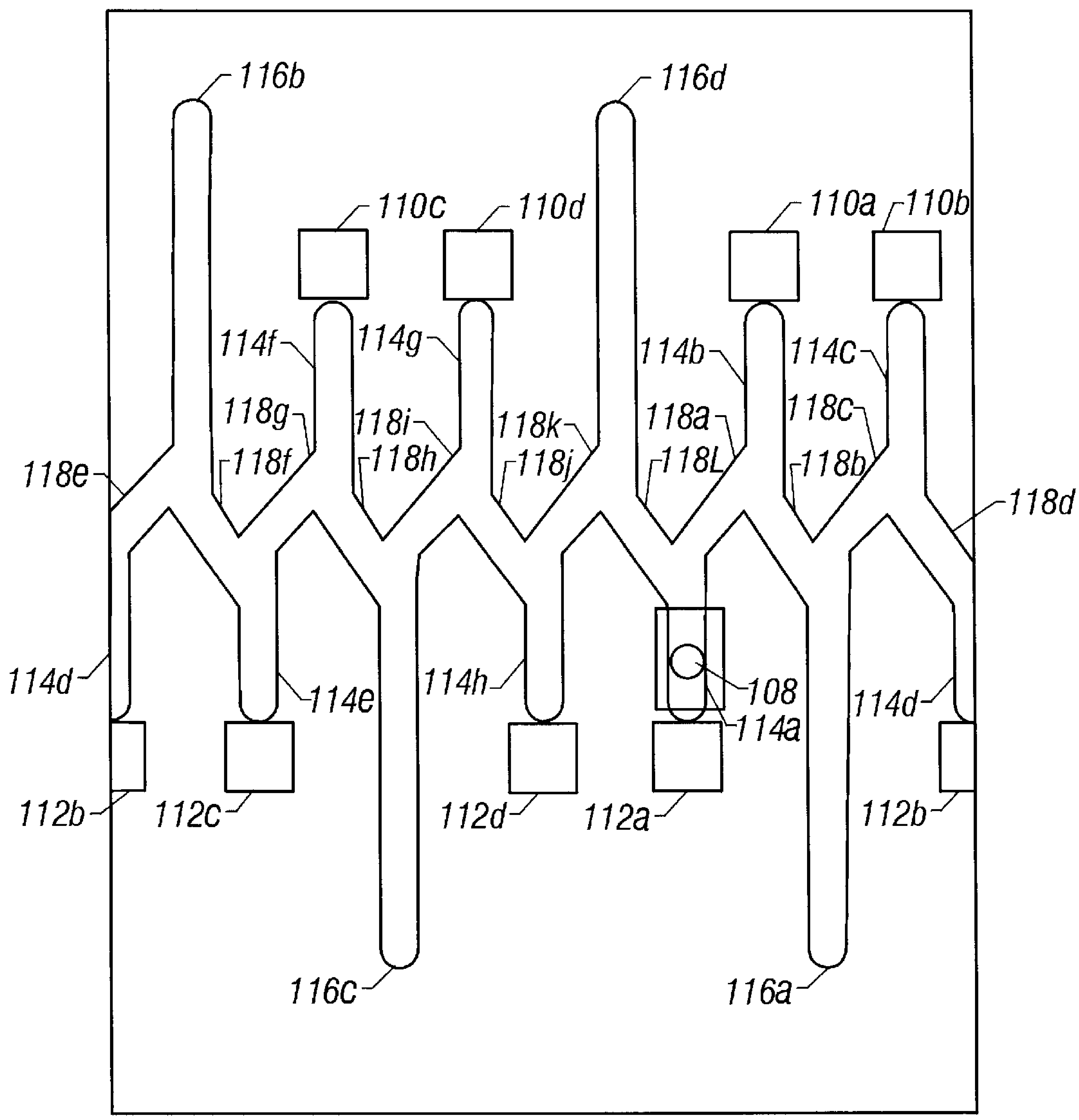


FIG. 1C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116d
110c
110d
110a
110b
114f
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114b
114c
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118i
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118e
118f
118h
118j
118L
118b
118d
114d
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114h
108
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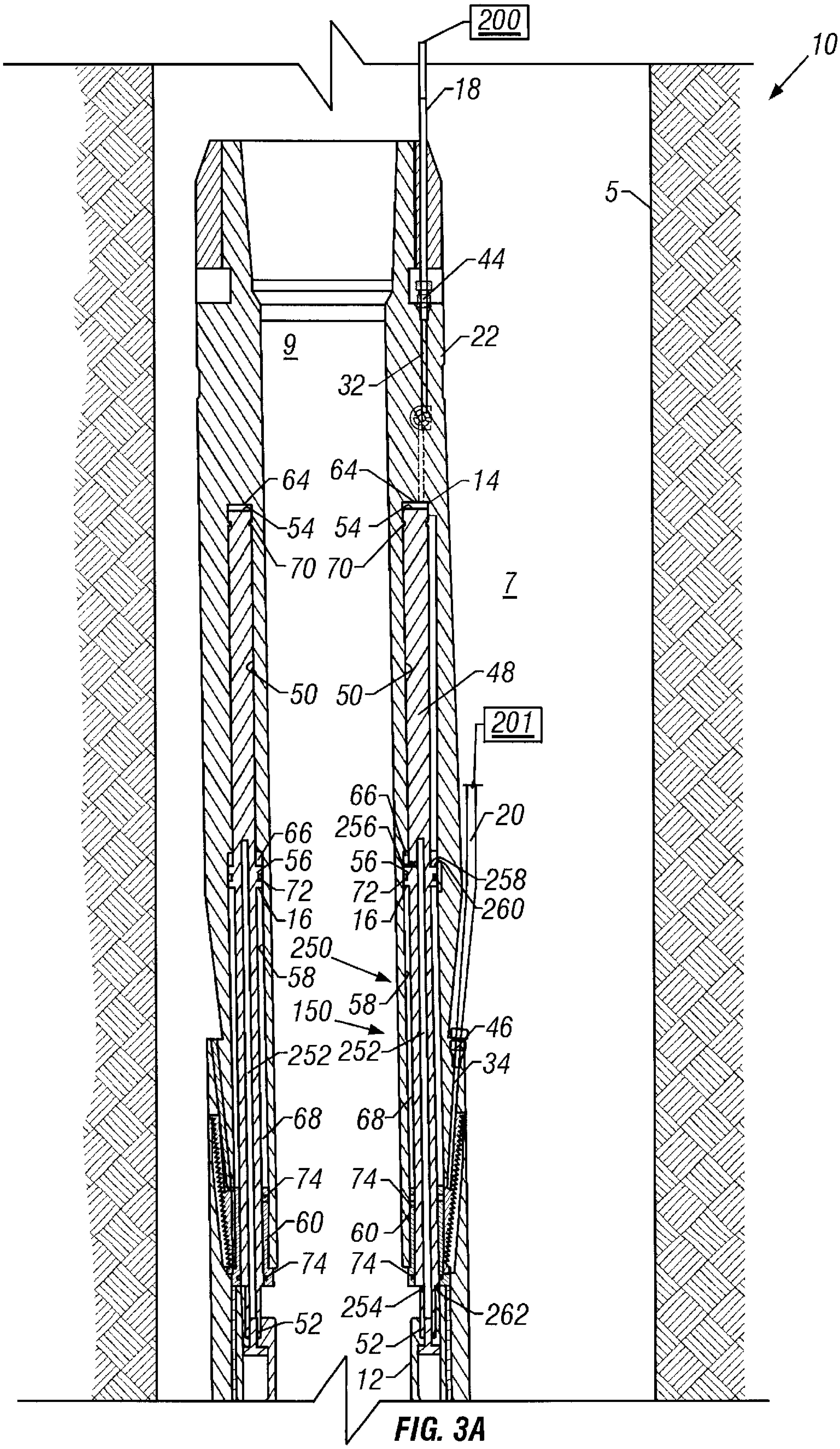
114d
112b
112c
112d
112a
112b
116c
116a

FIG. 2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10
18
5
44
22
9
32
64
64
14
54
54
70
70
7
50
50
48
201
66
256
20
66
56
56
258
72
72
16
16
260
250
58
58
150
46
252
252
34
68
68
74
74
60
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52
52
12

FIG. 3A

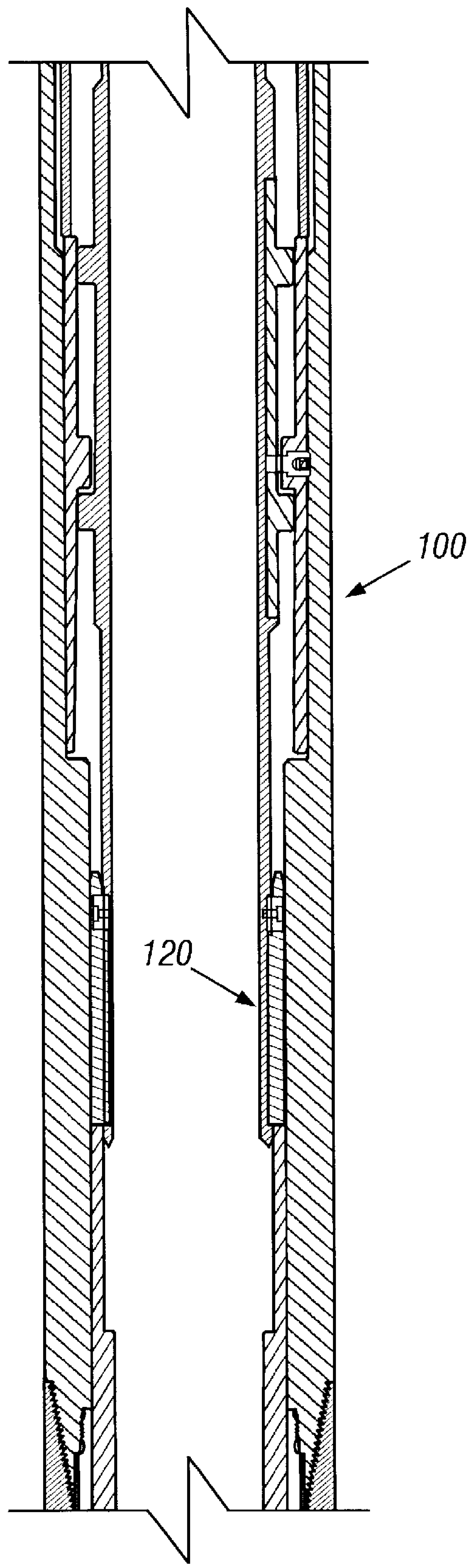

FIG. 3B

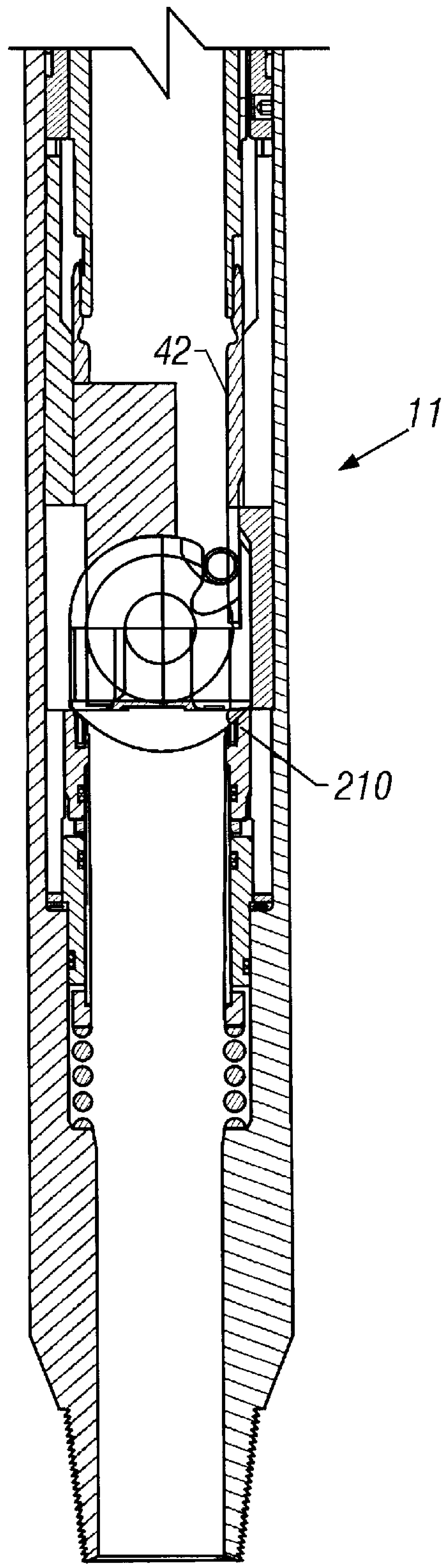

FIG. 3C

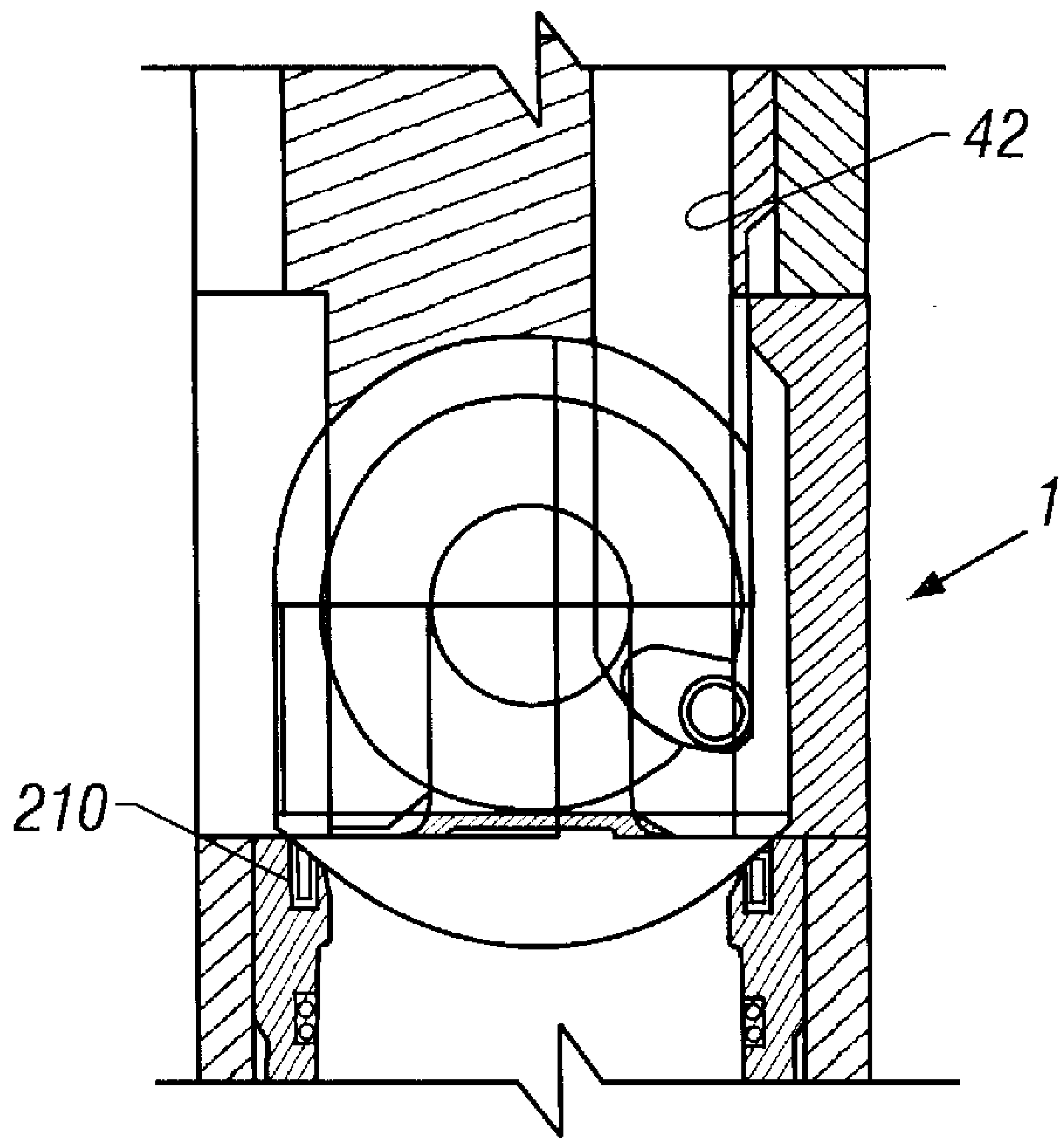

FIG. 4

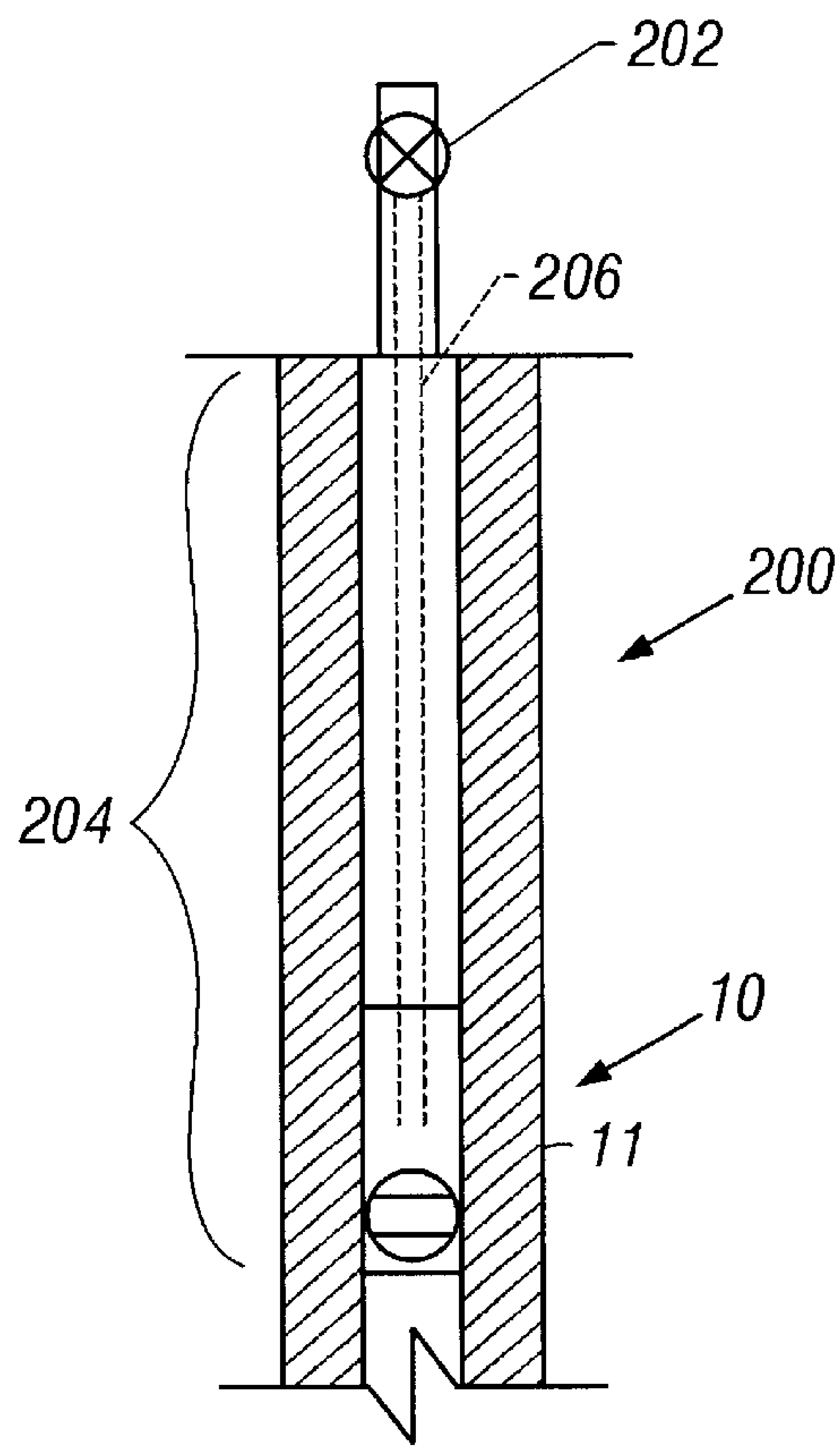

FIG. 5

ISOLATION VALVE

CROSS-REFERENCE TO RELATED APPLICATION

This claims the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Application Ser. No. 60/228,688, filed Aug. 29, 2000.

BACKGROUND

This invention generally relates to downhole tools, namely subsurface safety valves.

Safety regulations exist that require the placement of two mechanical pressure containment barriers at all times between the produced fluids in a wellbore and the environment. In subsea completions, when the blow out preventer or tree is removed, it has been general practice to close the surface controlled subsurface safety valve and install a tubing hanger plug by wireline prior to the removal thereby fulfilling the two barrier requirement. However, operators would rather not perform wireline interventions since they are generally costly, time-consuming, and invasive. The prior art would therefore benefit from a pressure barrier mechanism that fulfills the two barrier requirement and does not involve a wireline intervention.

In addition, the reliability and safety of each pressure barrier mechanism used in a subsea completion is highly critical. The accidental or inadvertent opening or closing of any of the pressure barrier mechanisms can result in a dangerous situation to personnel and equipment. Such accidental and inadvertent activations can be the result of leak paths formed in the mechanisms. It would thus also be beneficial to provide a pressure barrier mechanism that remains in its current position (either open or closed) despite the development of a leak path therein.

Also of relevance, lubricators can be used to add or remove sections from a tool string. It would be beneficial to provide a pressure barrier mechanism that could also be used as a downhole lubricator.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1A–1C** are a cross-sectional view of a first embodiment of the tool of this invention.

FIG. **2** is an unfolded view of one embodiment of the indexing mechanism of this invention.

FIGS. **3A–3C** are a cross-sectional view of a second embodiment of the tool of this invention.

FIG. **4** is a schematic of the valve member in the open position.

FIG. **5** is a schematic of the valve used as a downhole lubricator.

DETAILED DESCRIPTION

In the following description, numerous details are set forth to provide an understanding of the present invention. However, it is to be understood by those skilled in the art that the present invention may be practiced without these details and that numerous variations or modifications from the described embodiments may be possible.

My invention comprises an isolation valve **10** disposed in a wellbore **5**, the valve **10** being controlled from the surface and holding pressure from both its topside and underside. Valve **10** can be installed below the tubing hanger of the wellbore **5** as part of the remainder of the completion string. The valve's activating mechanism **150** ensures that the valve

10 fails in its current position and comprises an activating member **12** that includes at least one first surface **14** in fluid communication with a first source of hydraulic pressure **200** and at least one second surface **16** in fluid communication with a second source of hydraulic pressure **201**. In one embodiment, the first surface **14** surface area is equal to the second surface **16** surface area. The first source of hydraulic pressure **200** is in fluid communication with the first surface **14** of the activating member **12** through a first control line **18** (from the surface). Application of hydraulic fluid on the first surface **14** moves the activating member **12** in a first direction. The second source of hydraulic pressure **201** is in fluid communication with the second surface **16** of the activating member **12** through a second control line **20** (from the surface). Application of hydraulic fluid on the second surface **16** moves the activating member **12** in a second direction. When applying pressure through first control line **18**, it may be necessary to bleed second control line **20** in order to move activating member **12** in the first direction. When applying pressure second control line **20**, it may be necessary to bleed first control line **18** in order to move activating member **12** in the second direction. The movement of the activating member **12**, in turn, eventually changes the state of valve member **11** (by opening or closing valve member **11**), which is shown to be a ball valve in the Figures, but may comprise any number of acceptable valves such as flapper valves, disk valves, and/or sleeve valve. Ball member **11**, when in the closed position as shown in FIGS. **1A–1C**, may selectively engage seals **210** to hold pressure from above and below.

By way of example, FIGS. **1A–1C** show valve member **11** in the closed position. Application of hydraulic fluid on first surface **14** of activating member **12** through first control line **18** (and perhaps by also bleeding second control line **20**) moves activating member **12** in the downward direction, thereby eventually opening valve member **11** (as schematically shown in FIG. **4**). Thereafter, application of hydraulic fluid on second surface **16** of activating member **12** through second control line **20** (and bleeding of first control line **18**) moves acticating member **12** in the upward direction, thereby eventually closing valve member **11** (returning it to the position shown in FIGS. **1A–1C**).

The hydraulic fluid contained in the first source of hydraulic pressure **200** and the second source of hydraulic pressure **201** is the same density as, and may be the same fluid as, the fluid found in the annulus **7** of the wellbore **5**. If either the first control line **18** or the second control line **20** develops a leak, fluid from the annulus **7** will likely migrate into valve **10** and act against the first surface **14** or the second surface **16** of the activating member **12**. However, since the fluid in the annulus **7** is at least the same density as (and may be the same fluid as) the fluid in both control lines **18** and **20**, the force exerted by the annulus **7** fluid on the first or second surface, **14** or **16**, will not move the activating member **12** and will therefore not activate the valve member **11** (when no pressure is applied through first and second control lines **18** or **20**). It is noted that in the static position (no pressure applied through control lines **18** or **20**), each surface **14** and **16** sees only the hydrostatic pressure of the fluid within its respective control line **18** or **20**, which is the same as the hydrostatic pressure of the annulus **7** fluid at each surface **14** and **16**. The activating member **12** thus remains balanced despite the development of a leak path from the annulus **7**. Thus, the valve **10** fails "safe" in its then current position despite the development of such leak paths.

The valve **10** may also include an indexing mechanism **100** requiring more than one operation (or pressure cycle) of the activating member **12** to open or close the valve member **11**. This requirement further prevents the valve member **11** from accidentally opening or closing even if the activating member **12** is somehow moved once.

Activating mechanism **150** may also be used to activate downhole tools other than valve **10**, such as but not limited to packers, sliding sleeves, and liner hangers.

There are two primary embodiments of the valve **10** and the activating mechanism **150**: the first is shown in FIGS. **1A–1C** and the second is shown in FIGS. **3A–3C**.

First Embodiment

Turning to FIGS. **1A–1C**, activating member **12** is disposed within a mandrel **22** and includes an annular piston **24** that has the first surface **14** and the second surface **16** on opposing sides thereof. Mandrel **22**, as shown in the figures, may be constructed from a plurality of sections attached to each other, such as by threading. As previously disclosed, in one embodiment, the first surface **14** surface area is equal to the second surface **16** surface area. Annular piston **24** is slidably disposed within a groove **26** in mandrel **22** and divides groove **26** into a first chamber **28** and a second chamber **30**. First control line **18** is in fluid communication with first chamber **28** through a first port **32** in mandrel **22**. Second control line **20** is in fluid communication with second chamber **30** through a second port **34** in mandrel **22**. A chamber seal **36** is disposed between annular piston **24** and mandrel **22** so as to prevent fluid communication between first chamber **28** and second chamber **30**. Annular piston **24**, as shown in the Figures, may also be divided into two parts: an integral part **24*a*** that is integral to activating member **12** and a separate part **24*b*** that is releasably connected (such as by threads) to the activating member **12** and abuts the integral part **24*a***. In the embodiment including integral and separate parts, a chamber seal **38** is also disposed between separate part **24*b*** and activating member **12** so as to prevent fluid communication between first chamber **28** and second chamber **30**. In addition, to ensure that fluids within the bore **9** of the valve **10** do not migrate into either first chamber **28** or second chamber **30**, a tubing seal **40** is disposed between activating member **12** and mandrel **22** both above first chamber **28** and below second chamber **30**.

Upon application of pressure in first control line **18**, hydraulic fluid flows from first control line **18** into first chamber **28** and acts against the first surface **14** of activating member **12**. Hydraulic fluid within first chamber **28** is prevented from migrating into second chamber **30** by chamber seals **36** and **38** and is prevented from migrating into bore **9** by tubing seals **40**. If sufficient pressure is applied to first surface **14**, activating member **12** eventually moves in the first or downward direction. It is noted that it may be necessary to bleed second control line **20** in order to move activating member **12** in the first direction. At its lower end **42**, activating member **12** is functionally attached to the valve member **11**. Movement of the activating member **12** in the downward direction therefore eventually causes the valve member **11** to open, although downward movement may close the valve in other embodiments.

When it is desired to move activating member **12** in the second direction, first control line **18** is bled off and pressure is applied through second control line **20**. Upon application of pressure in second control line **20**, hydraulic fluid flows from second control line **20** into second chamber **30** and acts against the second surface **16** of activating member **12**. Hydraulic fluid within second chamber **30** is prevented from migrating into first chamber **28** by chamber seals **36** and **38** and is prevented from migrating into bore **9** by tubing seals **40**. If sufficient pressure is applied to second surface **16**, activating member **12** eventually moves in the second or upward direction. Movement of the activating member **12** in the upward direction eventually causes the valve member **11** to close, although upward movement may open the valve in other embodiments.

Thereafter, activating member **12** can be moved again in the first direction by bleeding off second control line **20** and applying pressure in first control line **18**. The cycle (first direction—second direction, or second direction—first direction) may be repeated by alternatingly bleeding and pressurizing first and second control lines **18** and **20**, as discussed above.

Fluid in the annulus **7** may migrate into the first chamber **28** either by the development of a leak path in the first control line fittings **44** or by a failure of the first control line **18**. If annulus **7** fluid enters the first chamber **28**, the annulus **7** fluid will act on the first surface **14**. However, since [i] the surface area of the first surface **14** is equal to the surface area of the second surface **16**, [ii] the fluid in the annulus **7** is the same density as (and may be the same fluid as) the fluid in the first control line **18** and the second control line **20**, and [iii] the hydrostatic pressure of the fluid in the first control line **18** at the first surface **14** is the same as the hydrostatic pressure of the annulus **7** fluid at the same surface, the action of the annulus **7** fluid on the first surface **14** does not by itself move the annular piston **24**. Therefore, in the static position (no pressure applied through control lines **18** or **20**), the activating member **12** also does not move and the migration of annulus **7** fluid into the first chamber **28** does not by itself result in the activation of the valve member **11**. Valve **10** thus fails "safe" in its then current position despite a leak in first control line **18**.

Fluid in the annulus **7** may also migrate into the second chamber **30** either by the development of a leak path in the second control line fittings **46** or by a failure of the second control line **20**. If annulus **7** fluid enters the second chamber **30**, the annulus **7** fluid will act on the second surface **16**. However, since [i] the surface area of the second surface **16** is equal to the surface area of the first surface **14**, [ii] the fluid in the annulus **7** is the same density as (and may be the same fluid as) the fluid in the first control line **18** and the second control line **20**, and [iii] the hydrostatic pressure of the fluid in the second control line **18** at the second surface **16** is the same as the hydrostatic pressure of the annulus **7** fluid at the same surface, the action of the annulus **7** fluid on the second surface **16** does not by itself move the annular piston **24**. Therefore, the activating member **12** also does not move and the migration of annulus **7** fluid into the second chamber **30** does not by itself result in the activation of the valve member **11**. Valve **10** thus fails "safe" in its then current position despite a leak in second control line **20**.

It is noted that as described valve **10** will fail "safe" in its then current position, which may be an open, closed, or intermediate (between fully open and fully closed) position, regardless of whether a leak is developed in the first and/or second control lines **18** and **20**.

Although not necessary, valve **10** may also include an indexing mechanism **100** (as shown in the figures) which ensures that more than one pressure cycle of activating member **12** is necessary to open or close the valve member **11**. Indexing mechanism **11** helps to ensure that valve member **11** will not be actuated (open or close) in case of seal or control line failure. Indexing mechanism **100** is functionally attached to the activating member **12** and may comprise a fixed indexer **102** and a rotating sleeve **104**. Indexer **102** may be formed on or attached to activating member **12** and includes a plurality of slots **106** and a plurality of upper stops **110** and lower stops **112**. Rotating sleeve **104** is rotatably disposed intermediate mandrel **22** and activating member **12** and includes a peg **108** that rides within slots **106** as will be disclosed herein.

FIG. **2** shows one embodiment of the indexer **102** and slots **106**, with the indexer **102** being unfolded. FIG. **2** also shows the peg **108** and the upper and lower stops **110** and **112**. Indexer **102** includes three types of slots **106**: short slots **114**, long slots **116**, and transfer slots **118**. It is assumed (only for purposes of illustration) that peg **108** is initially within short slot **114***a* and that it is prevented from further movement downward by lower stop **112***a*. Lower stop **112***a* is situated so that it does not enable activating member **12** to move downwardly enough to activate valve member **11**.

Upon downward activation of activating member **12** (as previously disclosed), peg **108** rides upward on short slot **114***a* (as rotating sleeve **104** rotates) and, due to the respective angles, peg **108** enters transfer slot **118***a* first and then enters short slot **114***b*. Peg **108** continues within short slot **114***b* until it hits upper stop **110***a* which prevents further movement of activating member **12**. Upper stop **110***a* is situated so that it does not enable activating member **12** to move downwardly enough to activate valve member **11**. Specifically, activating member **12** also includes a lost action mechanism **120** (known in the field) which prevents the transfer of longitudinal movement to the lower end **42** of the activating member **12** when peg **108** remains within a short slot **114**.

Upon upward activation of activating member **12** (as previously disclosed), peg **108** rides downwardly on short slot **114***b* (as rotating sleeve **104** rotates) and, due to the respective angles, peg **108** enters transfer slot **118***b* first and then enters long slot **116***a*. Long slot **116***a* does not have either an upper stop **110** or a lower stop **112**; therefore, the activating member **12** is allowed to move upward sufficiently enough to activate valve member **11**. Specifically, when peg **108** is in a long slot **116**, lost action mechanism **120** enables the transfer of longitudinal movement to the lower end **42** of the activating member **12**. The lower end **42** thus translates longitudinally thereby activating the valve member **11** (either open or closed).

Upon downward activation of activating member **12** (as previously disclosed), peg **108** rides upward on long slot **116***a* (as rotating sleeve **104** rotates) and, due to the respective angles, peg **108** enters transfer slot **118***c* first and then enters short slot **114***c*. Peg **108** continues within short slot **114***c* until it hits upper stop **110***b* which prevents further movement of activating member **12**. Upper stop **110***b* is situated so that it does not enable activating member **12** to move downwardly enough to activate valve member **11**. Specifically, the lost action mechanism **120** prevents the transfer of longitudinal movement to the lower end **42** of the activating member **12** when peg **108** remains within the short slot **114***c*.

Upon upward activation of activating member **12** (as previously disclosed), peg **108** rides downward on short slot **114***c* (as rotating sleeve **104** rotates) and, due to the respective angles, peg **108** enters transfer slot **118***d* first and then enters short slot **114***d*. Peg **108** continues within short slot **114***d* until it hits lower stop **112***b* which prevents further movement of activating member **12**. Lower stop **112***b* is situated so that it does not enable activating member **12** to move upwardly enough to activate valve member **11**. Specifically, the lost action mechanism **120** prevents the transfer of longitudinal movement to the lower portion **13** of the activating member **12** when peg **108** remains within the short slot **114***d*.

Upon downward activation of activating member **12** (as previously disclosed), peg **108** rides upwardly on short slot **114***d* (as rotating sleeve **104** rotates) and, due to the respective angles, peg **108** enters transfer slot **118***e* first and then enters long slot **116***b*. Long slot **116***b* does not have either an upper stop **110** or a lower stop **112**; therefore, the activating member **12** is allowed to move upward sufficiently enough to activate valve member **11**. Specifically, when peg **108** is in long slot **116***b*, lost action mechanism **120** enables the transfer of longitudinal movement to the lower portion **13** of the activating member **12**. The lower portion **13** thus translates longitudinally thereby activating the valve member **11** (either open or closed).

The slot **10** configuration of the indexer **102** illustrated in the Figures results in the activation of valve member **11** every third pressure cycle. In other words, the illustrated indexer **102** includes two short slots **114** between each long slot **116** so that the operator must go through three pressure cycles to move the peg **108** into a long slot **116** and therefore activate the valve member **11**. It is noted that the slot configuration can easily be changed so that the valve member **11** is activated at a different and desired number of pressure cycles. It is also noted that a different type of indexing mechanism **100**, as known in the field (such as ratchets, keys, and collets), can be used to ensure that the valve member **11** is not activated (open or close) until the completion of a given number of pressure cycles.

In this first embodiment, it is further noted that, since the tubing seals **40** above and below the first and second chambers **28** and **30** are the same diameter, the activating member **12** is balanced to the bore **9** of the valve **10**. Therefore, pressure fluctuations in the fluid disposed within bore **9** will not create movement in the activating member **12**.

Second Embodiment

Turning to FIGS. **3A–3C**, activating member **12** is disposed within a mandrel **22** and includes at least one rod piston **48**, each rod piston **48** having the first surface **14** and the second surface **16** disposed thereon. As previously disclosed, the first surface **14** surface area may be equal to the second surface **16** surface area. In one embodiment, a plurality of rod pistons **48** are slidably disposed, each within a cylinder **50** defined in mandrel **22**. At their lower ends **52**, each rod piston **48** is fixedly attached to the remainder of the activating member **12** so that slidable movement of the rod pistons **48** generates longitudinal movement of the activating member **12**. Intermediate their lower ends **52** and upper ends **54**, each rod piston **48** also includes an annular extension **56** slidably disposed within an enlarged portion **58** of the cylinder **50**. Within the enlarged portion **58** and proximate the rod piston lower ends **52**, each cylinder **50** also includes a fitting **60** that is fixedly attached to the cylinder **50** and that receives the rod piston **48**. First surface **14** is located on the upper end **54** of each rod piston **48**, and second surface **16** is located on the annular extension lower end **62**. A first chamber **64** is defined above each rod piston upper end **54**. The annular extension **56** divides cylinder enlarged portion **58** into a third chamber **66** and a second chamber **68**. A chamber seal **70** disposed proximate each rod piston upper end **54** between the rod piston **48** and the cylinder **50** prevents fluid communication between first chamber **64** and third chamber **66**. A chamber seal **72** disposed between the annular extension **56** and the cylinder **50** prevents fluid communication between third chamber **66** and second chamber **68**. Two chamber seals **74**, one disposed between the fitting **60** and the cylinder **50** and one disposed between the fitting **60** and the rod piston **48**, prevent fluid communication between the second chamber **68** and the bore **9** of the valve **10**.

First control line **18** is in fluid communication with first chamber **64** through a first port **32** in mandrel **22**. Second control line **20** is in fluid communication with second chamber **68** through a second port **34** in mandrel **22**. To ensure that first control line **18** is in fluid communication with the first chamber **64** of each rod piston **48**, a plurality of channels (not shown) are defined within mandrel **22** that provide fluid communication between all first chambers **64**. To ensure that second control line **20** is in fluid communication with the second chamber **68** of each rod piston **48**, a plurality of channels (not shown) are defined within mandrel **22** that provide fluid communication between all second chambers **68**.

Upon application of pressure in first control line **18**, hydraulic fluid flows from first control line **18** into all first chambers **64** and acts against the first surface **14** of each rod piston **48**. Hydraulic fluid within first chamber **64** is prevented from migrating into third chamber **66** by chamber seal **70**. If sufficient pressure is applied to first surface **14**, rod pistons **48** and therefore activating member **12** eventually move in the first or downward direction. It is noted that it may be necessary to bleed off second control line **20** in order to move activating member **12** in the first direction. At its lower end **42**, activating member **12** is functionally attached to the valve member **11**. Movement of the activating member **12** in the downward direction therefore eventually causes the valve member **11** to open, although downward movement may close the valve in other embodiments.

When it is desired to move activating member **12** in the second direction, first control line **18** is bleed of and pressure is applied through second control line **20**. Upon application of pressure in second control line **20**, hydraulic fluid flows from second control line **20** into all second chambers **68** and acts against the second surface **16** of each rod piston **48**. Hydraulic fluid within second chamber **68** is prevented from migrating into third chamber **66** by chamber seals **72** and is prevented from migrating into bore **9** by chamber seals **74**. If sufficient pressure is applied to second surface **16**, rod pistons **48** and therefore activating member **12** eventually moves in the second or upward direction. Movement of the activating member **12** in the upward direction eventually causes the valve member **11** to close, although upward movement may open the valve in other embodiments.

Thereafter, activating member **12** can be moved again in the first direction by bleeding off second control line **20** and applying pressure in first control line **18**. The cycle (first direction—second direction, or second direction—first direction) may be repeated by alternatingly bleeding and pressurizing first and second control lines **18** and **20**.

Fluid in the annulus **7** may migrate into the first chamber **64** either by the development of a leak path in the first control line fittings **44** or by a failure of the first control line **18**. If annulus **7** fluid enters the first chamber **64**, the annulus **7** fluid will act on the first surface **14**. However, since [i] the surface area of the first surface **14** is equal to the surface area of the second surface **16**, [ii] the fluid in the annulus **7** is the same density as (and may be the same fluid as) the fluid in the first control line **18** and the second control line **20**, and [iii] the hydrostatic pressure of the fluid in the first control line **18** at the first surface **14** is the same as the hydrostatic pressure of the annulus **7** fluid at the same surface, the action of the annulus **7** fluid on the first surface **14** does not by itself move the rod piston **48**. Therefore, the activating member **12** also does not move and the migration of annulus **7** fluid into the first chamber **64** does not by itself result in the activation of the valve member **11**. Valve **10** thus fails “safe” in its then current position despite a leak in first control line **18**.

Fluid in the annulus **7** may also migrate into the second chamber **68** either by the development of a leak path in the second control line fittings **46** or by a failure of the second control line **20**. If annulus **7** fluid enters the second chamber **68**, the annulus **7** fluid will act on the second surface **16**. However, since the surface area of the second surface **16** is equal to the surface area of the first surface **14** and the fluid in the annulus **7** is the same density as (and may be the same fluid as) the fluid in the first control line **18** and the second control line **20**, and [iii] the hydrostatic pressure of the fluid in the second control line **20** at the second surface **16** is the same as the hydrostatic pressure of the annulus **7** fluid at the same surface the action of the annulus **7** fluid on the second surface **16** does not by itself move the rod piston **48**. Therefore, the activating member **12** also does not move and the migration of annulus **7** fluid into the second chamber **68** does not by itself result in the activation of the valve member **11**. Valve **10** thus fails “safe” in its then current position despite a leak in second control line **20**.

It is noted that as described valve **10** will fail “safe” in its then current position, which may be an open, closed, or intermediate (between fully open and fully closed) position, regardless of whether a leak is developed in the first or second control lines **18** and **20**.

Each rod piston **48** may also include a balancing mechanism **250** that balances the rod piston **48** to the bore **9** of the valve **10** so that fluctuations in the pressure of the fluid in the bore **9** do not cause movement in rod piston **48**. It is noted that each rod piston **48**, proximate its lower end **52**, is open to the bore **9**. Therefore, without the balancing mechanism **250**, the fluids in the bore **9** would act to move rod piston **48**.

Balancing mechanism **250** comprises a channel **252** that may be defined in each rod piston **48**. Channel **252** is in fluid communication with the bore **9** of the valve **10** via first channel port **254** and is in fluid communication with the third chamber **66** via second channel port **256**. Thus, fluid from the bore **9** flows from the bore **9** into the third chamber **66**. Within the third chamber **66**, the fluid from the bore **9** acts on a third surface **258** defined on the upper end **260** of the annular extension **56**. Fluid from the bore **9** also acts on a fourth surface **262** of the rod piston **48** externally of the cylinder **50**. The surface area of the third surface **258** is equal to the surface area of the fourth surface **262**. Therefore, the rod piston **48** is balanced to the fluid found within the bore **9** and pressure fluctuations in such fluid do not act to move the rod pistons **48** (or activating member **12**).

The second embodiment may also include an indexing mechanism **100** and lost action mechanism **120** that function the same way as the indexing mechanism **100** and lost action mechanism **120** of the first embodiment.

In addition, either embodiment may include a profile defined on the activating member **12** which selectively mates with a profile defined on a shifting tool (not shown) deployed through the bore **9**. The shifting tool may be used as a backup to the control lines **18** and **20** to mechanically shift the activating member **12** in order to change the state of the valve member **11**. Furthermore, activating member **12**, in either embodiment, and as shown in the figures and described herein may be constructed from a number of functionally attached components.

The valve **10** can therefore be used as one of the two mechanical pressure containment barriers required by safety regulations when the blow out preventer or tree of a wellbore is removed. The valve **10** can be opened or closed from the surface without well intervention and fails “safe” in its then current position in the event of a leak.

FIG. **5** shows the valve **10** used a lubricator **200**. Valve member **11** may be closed (from the surface as disclosed herein) thereby isolating the pressure of the wellbore fluids underneath valve member **11**. At this point, it is possible to open surface valve **202** to inject or insert a section of tubing **206** (which may include other tools), such as coiled tubing, into the completion **204**. The length of the tubing section to be inserted can be varied by varying the distance between surface valve **202** and valve member **11**. Thus, valve member **11** can be included further down the completion **204** in order to accommodate a longer length of tubing section **206**. Once within the completion **204**, the surface valve **202** can be opened, the valve member **11** can be opened (from the surface), and the tubing section **206** can be inserted under the wellbore fluid pressure to its destination.

While the invention has been disclosed with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of the invention.

What is claimed is:

1. An activating mechanism for a downhole tool, the tool adapted to be deployed within a wellbore and a fluid filled annulus being defined intermediate the tool and the wellbore, comprising:

an activating member having a first surface and a second surface and adapted to change the state of the tool upon movement thereof;

a first source of hydraulic pressure in fluid communication with the first surface through a first control line;

a second source of hydraulic pressure in fluid communication with the second surface through the second control line; and

the fluid supplied by the first source of hydraulic pressure and the second source of hydraulic pressure having the same density as the fluid disposed within the annulus of the wellbore; and

wherein a leak in the first or second control line does not result in the movement of the activating member.

2. The activating mechanism of claim **1**, wherein the fluid is supplied by the first source of hydraulic pressure and the second source of hydraulic pressure is the same fluid as the fluid disposed within the annulus of the wellbore.

3. The activating mechanism of claim **1**, wherein the activating member is functionally attached to an indexing mechanism that requires more than one pressure cycle to change the state of the tool.

4. The activating mechanism of claim **3**, wherein the indexing mechanism includes a lost motion mechanism.

5. The activating mechanism of claim **1**, wherein:

the activating member includes an annular piston; and

the annular piston includes the first surface and the second surface.

6. The activating mechanism of claim **5**, wherein the first surface and the second surface are on opposite sides of the annular piston.

7. The activating mechanism of claim **6**, wherein:

the annular piston sealingly divides a first chamber and a second chamber;

the first chamber includes the first surface and is in fluid communication with the first source of hydraulic pressure; and

the second chamber includes the second surface is in fluid communication with the second source of hydraulic pressure.

8. The activating mechanism of claim **1**, wherein:

the activating member includes at least one rod piston; and

the at least one rod piston includes the first surface and the second surface.

9. The activating mechanism of claim **8**, wherein:

the at least one rod piston is slidably disposed within a cylinder defined on the mandrel of the tool; and

that at least one rod piston includes an annular extension slidably disposed within an enlarged portion of the cylinder.

10. The activating mechanism of claim **9**, wherein:

the first surface is located on the upper end of the at least one rod piston; and

the second surface is located on the lower end of the annular extension.

11. The activating mechanism of claim **10**, wherein:

the cylinder is sealingly divided into at least a first chamber and a second chamber;

the first chamber includes the first surface and is in fluid communication with the first source of hydraulic pressure; and

the second chamber includes the second surface and is in fluid communication with the second source of hydraulic pressure.

12. The activating mechanism of claim **11**, wherein:

the cylinder further includes a third chamber sealingly isolated from the first and second chambers; and

the third chamber is located intermediate the first surface and the annular extension.

13. The activating mechanism of claim **12**, further comprises a balancing mechanism to balance the at least one rod piston to the bore of the tool.

14. The activating mechanism of claim **13**, wherein the balancing mechanism comprises a channel defined in the at least one rod piston in fluid communication with the middle chamber and in fluid communication with the bore of the tool.

15. The activating mechanism of claim **14**, wherein:

the at least one rod piston includes a third surface defined on the upper end of the annular extension and a fourth surface defined proximate to lower end of the at least one rod piston and in fluid communication with the bore of the too;

the third surface is located within the third chamber; and

the surface area of the third surface is equal to the surface area of the fourth surface.

16. The activating mechanism of claim **1**, wherein the activating member includes a balancing mechanism to balance the activating member to the bore of the tool.

17. The activating mechanism of claim **1**, wherein the downhole tool comprises a valve.

18. The activating mechanism of claim **17**, wherein the valve comprises a ball valve.

19. The activating mechanism of claim **17**, wherein the valve holds pressure from above and from below.

20. The activating mechanism of claim **1**, wherein the surface area of the first surface is equal to the surface area of the second surface.

21. The activating mechanism of claim **1**, wherein application of fluid pressure from the first source to the first surface moves the activating member in a first direction changing the stare of the tool to a first state and application of pressure from the second source to the second surface moves the activating member in a second direction changing the state of the tool to a second state.

22. A downhole valve, the valve adapted to be deployed within a wellbore and an annulus being defined intermediate the valve and the wellbore, comprising:

an activating member having a first surface and a second surface;

the activating member adapted to change the state of the valve upon movement thereof;

a first control line in fluid communication with the first surface;

a second control line in fluid communication with the second surface; and

the fluid disposed within the annulus of the wellbore being the same density as a fluid disposed within the first and second control lines in the absence of any leak in either the first control line or the second control line;

wherein a leak in the first or second control line does not result in the movement of the activating member.

23. The valve of claim 22, wherein the surface area of the first surface is equal to the surface area of the second surface.

24. The valve of claim 22, wherein application of fluid pressure from the first source to the first surface moves the activating member in a first direction changing the state of the tool to a first state and application of pressure from the second source to the second surface moves the activating member in a second direction changing the state of the tool to a second state.

25. The valve of claim 22, wherein the activating member is functionally attached to an indexing mechanism that requires more than one pressure cycle to activate the change the state of the valve.

26. A method for ensuring that an activating mechanism of a downhole tool fails in its then current position, comprising:

providing an activating member on the downhole tool, the activating member having a first surface and a second surface and adapted to change the state of the tool upon movement thereof;

deploying the downhole tool in the wellbore, a fluid-filled annulus being defined intermediate the tool and the wellbore;

communicating a first source of hydraulic pressure to the first surface through a first control line;

communicating a second source of hydraulic pressure to the second surface through a second control line; and

supplying fluid from the first source of hydraulic pressure to the first surface and from the second source of hydraulic pressure to the second surface that is the same density as the fluid disposed within the annulus of the wellbore;

wherein a leak in the first or second control line does not result in the movement of the activating member.

27. The method of claim 26, wherein the surface area of the first surface is equal to the surface area of the second surface.

28. The method of claim 27, farther comprising bleeding the pressure applied by the second source against the second surface prior to applying fluid pressure from the first source to the first surface.

29. The method of claim 27, further comprising bleeding the pressure applied by the first source against the first surface prior to applying fluid pressure from the second source to the second surface.

30. The method of claim 26, comprising:

applying fluid pressure from the first source to the first surface to move the activating member in a first direction changing the state of the tool to a first state; and

applying fluid pressure from the second source to the second surface to move the activating member in a second direction changing the state of the tool to a second state.

31. The method of claim 26, wherein the state of the tool is changed after a given number of pressure cycles between the first source and the second source.

32. A method for preventing the inadvertent activation of a downhole valve disposed in a wellbore having a fluid-filled annulus, comprising:

providing an activating member on the downhole valve, the activating member having a first surface and a second surface and adapted to change the state of the valve upon movement thereof;

communicating a first hydraulic fluid to the first surface through a first control line;

communicating a second hydraulic fluid to the second surface through a second control line; and

supplying the first hydraulic fluid to the first surface and the second hydraulic fluid to the second surface so that each is the same density as the fluid disposed within the annulus of the wellbore;

wherein a leak in the first or second control line does not result in the movement of the activating member.

33. The method of claim 32, wherein the surface area of the first surface is equal to the surface area of the second surface.

34. The method of claim 32, further comprising:

applying fluid pressure from the first source to the first surface to move the activating member in a first direction changing the state of the tool to a first state; and

applying fluid pressure from the second source to the second surface to move the activating member in a second direction changing the state of the tool to a second state.

35. The method of claim 34, further comprising bleeding the pressure applied by the second source against the second surface prior to applying fluid pressure from the first source to the first surface.

36. The method of claim 34, further comprising bleeding the pressure applied by the first source against the first surface prior to applying fluid pressure from the second source to the second surface.

37. The method of claim 32, wherein the state of the tool is changed after a given number of pressure cycles between the first source and the second source.

38. A downhole valve disposed within a wellbore having a fluid filled annulus defined intermediate the tool and the wellbore, comprising:

an activating member adapted to change the state of the valve upon movement thereof;

at least one source of hydraulic pressure in fluid communication with the activating member; and

the fluid supplied by said at least one source of hydraulic pressure having the same density as the fluid disposed within the annulus of the well.

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